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**HEADLINE:** Device may spark clean-running cars

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**BODY:**

It's no bigger than a beer mug, but the simple device developed in Daniel Cohn's lab at the Massachusetts Institute of Technology has the potential to make significant reductions in the already drastically-improved emissions from ordinary cars. Cohn, who has been working on the concept since 1993, last month won an innovation award from Discover magazine for the patented device, which cleans up emissions by producing pure hydrogen that is added to the engine's fuel mixture. This allows the engine to burn cooler and leaner (that is, with more air in the mix).

The device is quite simple: Fuel enters a chamber, mixes with air, and then is zapped with electricity. That creates a plasma - an electrically-charged gas - which then causes carbon from the fuel to join with oxygen from the air. This leaves a mixture of carbon monoxide and hydrogen, both of which can be burned up by the engine.

"It's well known that hydrogen improves the environmental qualities" of a conventional engine, said Cohn, who is director of MIT's Plasma Science and Fusion center. The hard part has always been producing the hydrogen.

Although the first tests of the device connected to a conventional engine are just beginning at the US Department of Energy's Oak Ridge National Laboratory, calculations based on lab tests of the device by itself show that it should reduce nitrogen oxide emissions - a major component of smog - by 90 percent. "A number of major car companies have talked to us," he said, "both US and foreign." But he said it would not be appropriate to name the companies at this early stage of discussions.

"The principle of what he's talking about is sound and attractive," said Daniel Sperling, director of the Center for Advanced Automotive Research at the University of California at Davis. But, he said, there are some unanswered questions, such as: how cheaply can it be manufactured, and what kind of maintenance issues might it encounter?

But an even bigger question, Sperling said, is how much need there is for such a device in the first place. Since new cars - and especially the newer cars coming in the next few years - are already vastly cleaner than their predecessors, "the demand for a device of this kind is not nearly as great as 10 years ago."

The progress - which Sperling attributes in large part to strict regulations such as California's air-quality rules - has been far greater than virtually anyone expected. "The new cars, for all practical purposes, are zero-emitting," he said. "It's extraordinary what they've done."

Cohn agrees that the new cars are much cleaner, but points out that the major companies are still spending hundreds of millions of dollars in a quest for even cleaner cars. Also, some trucks and buses - where much greater improvements are needed because their larger engines produce more emissions - run on conventional spark-ignition engines, and thus could use the new device.

Besides offering cleaner emissions during ordinary operation, said Cohn, with his device the engine can run on virtually pure hydrogen during startup - when the greatest emission of pollutants usually occurs, because the car's

catalytic converter has not yet warmed up to its operating temperature. Startup emissions would be drastically reduced by such a system, he said. Already, Volvo has been working on a different technique for providing pure hydrogen to the engine during startup.

"This device could greatly reduce air pollution from cars, trucks, and buses, using present internal combustion technology, without a major increase in costs and without any inconvenience to the driver," Cohn said.

But that's just one of the potential benefits of the device, Cohn said in an interview. Dubbed the "microplasmatron," it could also allow a variety of unconventional or unrefined fuels - including natural gas, diesel, and even ordinary vegetable oil - to be used in car engines. That's because it is essentially an on-board refinery that could allow crude, unprocessed fuels to be converted to pure, clean-burning hydrogen as they enter the engine.

By enabling the use of unconventional plant-derived fuels, such as oils derived from agricultural waste products, in ordinary engines, the device could theoretically help to curb global warming, Cohn said. That's because the carbon in those fuels is actually drawn from the air as the plants grow and is then given back off as the fuels burn. Unlike fossil fuels, they therefore have no net effect on the amount of carbon dioxide - a major contributor to global warming - in the atmosphere.

Roland Hwang, automotive technology analyst for the Union of Concerned Scientists, said that while he had not heard of Cohn's device specifically, it would be "terrific if it's cost effective, as long as it doesn't reduce fuel economy."

While Sperling is skeptical of the device's significance for passenger cars, he says if it can be adapted to diesel engines as well - which Cohn says may be possible - there could be huge demand. "Diesel engines are so dirty, and it is so expensive to reduce their emissions," Sperling said. "... Diesel manufacturers are under huge pressure, and they really don't know what to do."

Cohn said such applications are more speculative, because very little research has been done on the effects of adding hydrogen to diesel engines. "There is some indication it will have a beneficial effect," he said last week as he was on his way to a conference in Maine on improving the efficiency and emissions of diesel engines, "but whether it's significant or not, we don't know at this time."

The research so far, done with just \$300,000 of Department of Energy funding - a pittance by automotive research standards - was done in collaboration with Leslie Bromberg and Alexander Rabinovich, research engineers at the MIT lab, and Charles Titus of T&R Associates, a Pennsylvania consulting company.

The team at MIT has now received additional funding from the Department of Energy to do more advanced research on establishing the feasibility of the microplasmatron for widespread use, Cohn said.

**GRAPHIC: PHOTO,** Daniel Cohn, who heads MIT's Plasma Science and Fusion Center, has invented a device to make cars run cleaner.

PHOTO COURTESY/MARY PAT McNALLY

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